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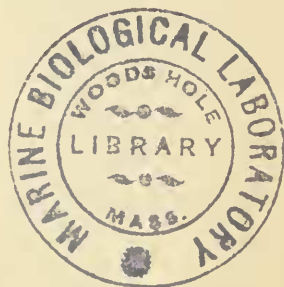
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No. 3

PUGILLUS ASTRAGALORUM ALTER

BY

R. C. BARNEBY



THE OBSERVATIONS on *Astragalus* contained in the present paper† are based primarily on material gathered by Mr. H. D. Ripley and the writer in California, Nevada, Utah, and Arizona during the past two or three years. Through the kindness of Dr. P. A. Munz it has been possible to make critical comparisons with a number of types in the herbarium of Marcus E. Jones at Pomona College (PO), without which these notes could not have been prepared. In addition, the writer has had an opportunity to visit several herbaria in the East, and there to study type and other specimens not represented in California collections. To the gentlemen in charge of these herbaria, in particular to Prof. M. L. Fernald of the Gray Herbarium at Harvard University (G), Dr. H. A. Gleason of the New York Botanical Garden (NY) and Dr. P. C. Standley at the Field Museum (F), who generously placed at my disposal the collections in their care, I wish to express my lively appreciation. I am also especially grateful to Miss Alice Eastwood for the communication of the type specimen of *Astragalus Bryantii*, described below. The capital letters in parentheses have been used throughout the paper to denote the herbarium in which cited material has been seen.

Types of all species and varieties described as new are deposited in the herbarium of the California Academy of Sciences together with duplicates of the collections discussed.

† Mr. Barneby's earlier paper on *Astragalus*, "Pugillus Astragalorum Nevadensium," was published in Leaflets of Western Botany 3:97-114, figs. A-F. 1942.

***Astragalus diversifolius* A. Gray**

*Astragalus diversifolius* A. GRAY, Proc. Amer. Acad. 6:230. 1864. *Homalobus orthocarpus* NUTT. ex T. and G., Fl. N. Amer. 1:351. 1838. *A. convallarius* Greene var. *diversifolius* (A. GRAY) Tidestr., Proc. Biol. Soc. Wash. 50:20. 1937.

UTAH: clay slopes among junipers, 3 miles south of Enterprise, Washington Co., alt. 6300 ft. *Ripley and Barneby 4967*.

This station extends the range of the species as known to the writer almost to the borders of Arizona, to which state it is accredited by Tidestrom (Fl. Ariz. and N. Mex. 197. 1941), though not admitted by Kearney and Peebles, who record only *A. junciformis* A. Nels. of this immediate group as native to the state. Prof. Tidestrom's plant is unknown to me, but his combination is in any case untenable. If the plants originally named by Nuttall as *Homalobus orthocarpus* and *H. campestris* cannot be separated specifically, the oldest valid binomial for either element of the complex must be given the rank of species, not reduced to varietal status under a subsequently published name. *A. diversifolius* A. Gray, founded on *H. orthocarpus*, appeared 29 years earlier than *A. convallarius* Greene (1893), which was proposed to replace *A. campestris* (Nutt.) A. Gray (1864) non Linné (1753). Even if the combination *A. diversifolius*, often wrongly applied, were discarded as a *nomen confusum*, *A. ibapensis* M. E. Jones, in all probability an exact synonym of *H. orthocarpus* and published in January of 1893, will take precedence over *A. convallarius* published in October of the same year. But the taxonomy and involved nomenclature of this group are still in need of critical revision.

***Astragalus Whitedii* Piper fma. *speirocarpoides* Barneby, forma nova**

(Plate 17, fig. 31)

*Astragalus Whitedii* Piper fma. *speirocarpoides* Barneby fma. nov. a prole typica (seu *A. speirocarpo* var. *falciformi* A. Gray) legumine in annulum saltem completum vel saepius sesquialterum contorto, nee faleato tantum, diversa.

NEVADA: in deep sandy soil among sagebrush, 10 miles north of Winnemucca, Humboldt Co., alt. 4500 ft., 23 May, fl. and fr. *Ripley and Barneby 4552*. Type in Herb. Calif. Acad. Sci. No. 300414. Also at Austin, Lander Co., Jones, 16 June 1882 (PO, annotated as *A. Gibbsii* var.).

With its fruit twisted into one or one and a half spiral coils, the proposed forma is very similar in aspect to the true *A. speirocarpus* A. Gray of Washington and northern Oregon, but the long calyx (tube 8 mm.), rather coarse, procumbent stems and broad leaflets are all characteristic of *A. Whitedii*, in the typical form of which the pods are not more than strongly falcate. It should be noticed that the fma. *speirocarpoides* invalidates Rydberg's key to *Homalobus* Ser. *Collini* (N. Amer. Fl. 24: 258. 1929), from which this plant would appear to belong to *A. speirocarpus*.

**Astragalus zionis** M. E. Jones

*Astragalus zionis* M. E. Jones. *Xylophacos zionis* (Jones) Rydb.

ARIZONA: sandy declivities under the Echo Cliffs near Limestone Tanks, about 13 miles south of Navajo Bridge, alt. 5200 ft., 7 June, fr. Ripley and Barneby 4868.

Also observed, but not collected, under the same cliffs 11 miles north of Cedar Ridge.

An addition to the flora of Arizona. The specimens are slightly abnormal in having the peduncles much shorter than is usual in material from Zion and the Virgin Valley, while the whole plant is more copiously pubescent.

**Astragalus panguicensis** M. E. Jones

*Astragalus panguicensis* (M. E. Jones), M. E. JONES, Contrib. W. Bot. 10:62, tab. 4. 1902.

*A. Chamaeleuce* var. *panguicensis* M. E. JONES, Proc. Calif. Acad. Sci. (II), 5:671. 1895.

*A. argophyllus* var. *panguicensis* M. E. JONES, Contrib. W. Bot. 8:5. 1898; Rev. Astrag. 207, tab. 47. 1923. *Xylophacos vespertinus* RYDB., N. Amer. Fl. 24:299. 1929, pro parte, quoad syn. cit., non *A. vespertinus* Sheld.

UTAH: gravelly benches in yellow pine forest west of Alton, Kane Co., alt. 6800 ft., 5 June, fl. and fr. Ripley and Barneby 4822.

It is not without some misgiving that the collection is referred to this obscure species, for the type, Jones 6023 f, and only specimen of *A. Chamaeleuce* var. *panguicensis* at Pomona is a very mature and imperfect plant without either flower or fruit. In an envelope attached to the sheet there is a single pod marked in Jones' hand "probably the type of *A. panguicensis*," but this creates a further difficulty, for the pod does not agree as closely with the figures or description published by Jones as do the fruits of our specimens, and it may never have belonged there. The plant itself differs from ours in being evidently caulescent and in having, for the most part, broader and more obtuse leaflets. Many species of this group, however, even if quite stemless at first, tend to become caulescent late in the season, and we have one specimen which in shape of leaflets closely matches the type. In both collections the stipules and the characteristically dense, silvery, subappressed pubescence are identical, and it should be remembered that the type locality, Panguitch Lake, is in the same massif as our station and not more than twenty miles distant. Certainly our plant can be referred to no other described species.

If our determination is accepted as correct it becomes evident that *A. panguicensis* has been universally misunderstood. Jones first described it as a variety of *A. Chamaeleuce* A. Gray, three years later transferred his variety to *A. argophyllus* Nutt., then raised it to specific rank, and finally, in the Revision of *Astragalus*, returned it as a variety to *A. argophyllus*. Rydberg, evidently without first-hand knowledge of the plant, reduced it to the very different *A. vespertinus* Sheld. Actually the small, pale purple or ochroleucous flowers and the quality of the pubescence suggest an affinity with *A. castaneiformis* S. Wats., from which it is immediately distinguished by the curved, lanceolate and much longer pod.

***Astragalus uncialis* Barneby**

NEVADA: Currant (Callaway), Nye Co., 12 May, flor. *Ripley and Barneby 4421*, topotype. Also 20 miles to the west, in the foothills of the Pancake Range near Lockes. No. 4423.

*A. uncialis* was described from fruiting material and the fresh flower was unknown. As surmised by the writer, the corolla is of a brilliant purple, similar to that found in *A. utahensis* (Torr.) T. & G. though perhaps of a somewhat more violet tinge.

***Astragalus marianus* (Rydb.) Barneby comb. nov.**

*Xylophacos marianus* RYDB., Bull. Torr. Cl. 52:233. 1925; N. Amer. Fl. 24:301. 1929. *A. Purshii* × *Newberryi* M. E. JONES, Rev. Astrag. 216. 1923.

NEVADA: frequent on dry benches under pines and aspens along Snake Creek, near Treasure Lake, Snake Range, White Pine Co., alt. ca. 8200 ft., July, fr. *Ripley and Barneby 4036*.

This rather well-marked species has been reported only from the mountains of southern and central Utah, where it is of not uncommon occurrence in sagebrush valleys between six and eight thousand feet. The plants from Nevada are not identical with the type, but have the broader leaflets of *Fremont 406* (NY) from Utah Lake referred to *X. marianus* by Rydberg (*l. c.*, 1925), and without doubt represent a shade form of the species. Another gathering from the state, our no. 3515 from talus slopes beneath limestone cliffs in the canyon of the Muddy River near Caliente, Lincoln County, at 4500 feet may also belong here, but the determination is not certain. The specimens resemble *A. marianus* closely in habit, in the slender, often well-developed caudices and numerous, small, appressed-sericeous leaflets, but in the dense floccose pubescence of the pods they recall *A. Newberryi* A. Gray or even *A. Blyae* (Rose) Tidestr. The locality is well below the normal altitudinal limit of *A. marianus* and it may be that the plants had seeded down from a higher level of the Highland Range into a soil where lack of humidity and greater temperature might account for the increased density of vesture. Further investigation, particularly of the flowers, may reveal an undescribed species.

***Astragalus sabinarum* (Rydb.) Barneby comb. nov.**

*Batidophaca sabinarum* RYDB., N. Amer. Fl. 24:320. 1929.

Only the type specimen from Iron County, Utah (*Garrett R2660*, NY), has been seen by the writer, but this clearly represents a good species. The combination in *Astragalus* is proposed in order to facilitate comparison with its nearest ally, *A. musimonum* nob., described below.

***Astragalus musimonum* Barneby sp. nov.**

(Plate, 17, figs. 1-9)

*Astragalus musimonum* Barneby sp. nov. ex affinitate *A. sabinarum* (Rydb.) nob. a quo pendunculis validis elongatis folia multo superantibus, racemis plurifloris, dentibus calycinis abbreviatis haud nigro-ciliatis, et praesertim legumine parcius strigoso ad

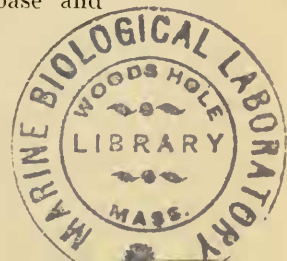


apicem abrupte hamato-recurvo facillime diagnoscenda. Habitu *A. amphioxys* A. Gray affinesque nonnullas species aliquantulum refert, sed calyce campanulato carinaque lata ab *Argophyllis* (sive *Xylophacis* Rydb.) omnibus graviter discrepat.

Herba perennis depressa caespitosa breviter caulescens, pilis argenteis adscendentibus basifixis imprimis arete appressis paucisque patulis commixtis undique strigoso-cana: caulibus compluribus prostratis saepe flexuosis incanis e collo radiis lignosae verticalis emissis, 2-7 cm. longis, fere ex ipsa basi racemigeris: stipulis primum imbricatis demum internodio 3-9 mm. longo separatis, lanceolatis vel ovato-lanceolatis acutis, 3-5 mm. longis, praeter nervum mediaum viridem omnino hyalinis vel superne herbaceis, mox scariosis, inferne glabratis intus glabris longe ciliatis ad basin petiolo breviter adnatis: foliis humi appressis 4-10 cm. longis, petiolo gracili elongato leviter canaliculato rachin saepissime superanti: foliolis 5-9-jugis parvis remotiusculis inferioribus plerumque alternis articulatis obovatis ellipticis oblanceolatisve, apice rotundatis acutis vel apiculatis 3-7 mm. longis, 2-3 mm. latis, secus rachin sursum decrescentibus: pedunculis numerosis, praecocioribus subradicalibus, prostratis validis striatis parcius strigosis viridulis, iam ad anthesin folia superantibus fructiferis elongatis: racemis brevibus 7-12-floris primum subcapitatis ca. 1.5 cm. longis, mox laxioribus, demum 4-6 cm. longis: bracteis ovato-acuminatis ca. 3 mm. longis hyalinis ciliatis: pedicellis firmulis, vix 1 mm. longis, adscendentibus: calycis purpureo-tincti extus strigoso-cani tubo campanulato postice valde gibbo 3.5 mm. longo, 2 mm. lato, legumine accrescenti nunquam rupto, dentibus subulatis acutis 1.5 mm. longis: petalis laete violaceo-purpureis, vexillo macula magna elliptica alba superne pulchre pluristriata instructo: vexillo 12-14 mm. longo, supra unguiculum brevem et angustum in limbum plicatum late oblongum 4 mm. latum obtusum apice emarginatum abrupte expanso, infra medium plus minusve retro-arcuato, marginibus reflexis: alis ca. 10 mm. longis, carinam paululum superantibus, lamina anguste lanceolato-lunata ca. 1.5 mm. lata, auriculo parvo reflexo incluso 7 mm. longa: petalorum carinalium lamina oblique ovato-lunata 6 mm. longa, saltem 2.5 mm. lata, marginibus superioribus leviter concavis, inferioribus connatis supra medium in apicem porrectum plerumque obtusissimum per angulum fere rectum sursum arenatis: legumine patulo sessili uniloculari, ambitu anguste elliptico, falcato, 1.5-2.0 cm. longo, utrinque angustato atque compresso, medium versus admodum obcompresso vel saltem dorsaliter sulcato, in rostrum abrupte hamato-recurvum stylo persistenti cuspidatum sursum attenuato, sutura ventrali per longitudinem totam acuta sensim concava, dorsali inferne subrecta, ad medium prominula sed ob leguminis obcompressionem ibi depressa, ad rostrum acutissima abrupte convexa, sectione transversali anguste obcordata 5-6 mm. lata, ca. 2 mm. alta, valvulis coriaceis sparsiuscule albostrigosis transverse striatis immaculatis: seminibus maturis ignotis.

NEVADA: calcareous gravel slopes of the **Sheep Mts., near the entrance to Deadman Canyon, Clark Co.**, alt 5700 ft., 5 May, fl. & fr. *Ripley and Barneby 3332*. Type in Herb. Calif. Acad. Sci. No. 300411.

*A. musimonum*, with its caespitose, very shortly caulescent, prostrate stems, silvery-strigose herbage and racemes of purple flowers, has at first sight the aspect of a slender form of *A. amphioxys* A. Gray, but the campanulate calyx-tube, broad keel and thin-walled pod indicate a relationship with that group of *Astragali* segregated by Rydberg as the genus *Batidophaca*, and among those species it finds a natural place beside *A. sabinarum* in the series *Villosae* (cf. Rydb., *l. c.*). From the latter it differs in the short calyx-lobes, more numerous flowers and more copious pubescence of straight, appressed hairs, while the mature fruits, laxly racemose on the stout, elongate and at length reclining peduncles, are comparatively glabrate, attenuate at base and



abruptly hooked at apex, in contrast with the canescent, regularly lunate pod of *A. sabinarum*.

*A. musimonum* has been known in the type locality on the western slope of the Sheep Mountains for several years, but adequate fruiting material has only recently been obtained. In this station it is local but abundant on calcareous benches in the Upper Sonoran Life-zone and seems to belong to the calciphile foothill flora of which, in southern Nevada, *Actinæa Cooperi* (A. Gray), O. Kze., *Senecio stygius* Greene and *Astragalus Tidestromii* (Rydb.) Clokey are characteristic elements. Immature specimens from northern Arizona, found growing under similar conditions at 5300 feet in Mokiak Pass, Mohave County (No. 4321), are almost certainly to be referred to *A. musimonum*, but in absence of the legume the determination remains in doubt.

The proposed trivial, from the Latin 'musimon,' alludes to that magnificent race of the Mountain Sheep, now happily preserved from extinction, which is native to the Sheep Mountains, and from which the name of the range itself is certainly derived.

### ***Astragalus pinonis* M. E. Jones**

*Pisophaca pinonis* (M. E. Jones) Rydb.

NEVADA: Highland Range west of Caliente, Lincoln Co., alt. 5200 ft., 20 May, fl. & fr. *Ripley and Barneby 3487a*. Currant Creek, N. E. Nye Co., alt. 6200 ft. No. 3640.

This rare species has been known hitherto only from Beaver (Friseo, Jones, the type collection) and eastern Juab (Tintie, Jones) Counties, Utah. Our specimens are taller and better developed than Jones' evidently depauperate type, with pods up to 2.5 cm. in length, but they are essentially alike in structure and pubescence. The plants were found only as isolated individuals and appeared very scarce.

### ***Astragalus oophorus* S. Wats.**

NEVADA: Head of Lee Canyon, Charleston Mts., Clark Co., alt. 9100 ft., *Ripley and Barneby 4979*.

Through the kindness of Mr. Ira W. Clokey it has been possible to compare this collection with *Train 2141* from the same locality which was cited in a recent paper on the Astragali of the Charlestons (Clokey, Madroño 6: 217. 1942) as *A. artipes* A. Gray. Study of the more ample material now available makes it clear that the Charleston plant is more justly referred to *A. oophorus*, but the original determination, which was made by the Bureau of Plant Industry and based on meager and somewhat atypical specimens, is readily understandable when it is realized how variable and how closely allied the species are, and how incorrectly they have been interpreted in the past.

In fact there seems to be little ground on which *A. oophorus* and *A. artipes* can be separated specifically, for, while the typical phases occupy distinct, contiguous areas, there occur, particularly toward the southern limit of *A. oophorus*, specimens which are to some degree intermediate. *A. artipes* of

northern Arizona, middle Utah and adjacent Colorado is distinguished by the cream-colored flowers and by the oblique legume with nearly straight ventral and strongly convex dorsal sutures. *A. oophorus*, on the other hand, a common species throughout central Nevada which extends into transmontane California along Owens Valley to the Panamints, has flowers with purple banner and keel, and a regularly ellipsoid pod with either suture about equally convex. In southern Nevada and in the Panamints, however, purple-flowered plants are sometimes found with somewhat oblique legumes, in which case the only absolutely reliable criterion is the color of the flowers. This raises a serious difficulty, since Watson, in the original publication, described the flowers of *A. oophorus* as ochroleucous. This I believe to have been an error. Not only is the pigment in the petals of *A. oophorus* extremely fugacious in the herbarium, but among the numerous collections of the species made in Nevada in recent times not one with ochroleucous flowers has been detected. I have myself collected the species to the north, south and east of the type-locality (at Austin, in the Toyabe Range and in Montgomery Pass), yet among thousands of individuals none was observed without purple keel and banner. Apart from the value of the flower color as a taxonomic criterion,\* the matter is of special importance in so far as it has affected the interpretation of *A. oophorus* by Jones and Rydberg. Evidently it was a factor in Jones' treatment of *A. artipes* from middle Utah as *A. oophorus* (and simultaneously of the purple-flowered *A. oophorus* as *A. artipes*), while it also prompted Rydberg to recognize in *A. oophorus* two species of *Phaca*, *P. oophora* and *P. jucunda*, separated mainly by this very character.

For many years Jones seems to have considered these two names synonymous, and in the Index to the Revision of Astragalus he actually stated that "*A. artipes* . . . is *oophorus*." Nevertheless his real intentions at this time seem to have been otherwise, for on Plate 22 of the same work appears a figure under the name "var. *artipes*" and the combination is repeated in the Index to Plates. By a curious misprint, however, it was not validly published. On page 121 of the Revision, immediately following a detailed description of *A. oophorus* (in which the pod described is clearly that of *A. artipes*) are printed two short paragraphs, both under the heading *A. oophorus* var. *caulescens*. There seems to be no doubt that the first line of the upper paragraph should have read "*A. oophorus* var. *artipes* (Gray, Proc. Amer. Acad. 13. 370)" which would join on comprehensively with "(1878) as species)" of the second line. But Jones' confusion went deeper than a mere typographical lapsus, for the plant figured as var. *artipes* is plainly nothing more than *A. oophorus* in the strictest sense, while the true *A. artipes* of Gray is represented by the *A. oophorus* var. *caulescens* of the second paragraph and of the

\* An exact parallel is found in the case of *A. Beckwithii* T. and G. and its vicariant var. *purpureus* M. E. Jones (*A. artemisiarum* M. E. Jones). The former, with ochroleucous flowers, so common in western Utah, passes westward, almost exactly at the Nevada line, into a form with purple flowers.

corresponding figure on Plate 22. This point has been verified by study of the typical material of *A. megacarpus*, var. *caulescens* M. E. Jones (PO). It should also be noted that the figures of what Jones regarded as typical *A. oophorus* on Plate 21 contain a mixture: true *A. oophorus* is there represented only by the upper pod and section, while the remainder (marked "a," from Mammoth, Utah) are quite characteristic of *A. artipes* and in no way separable from the figure of var. *caulescens* on Plate 22. A touch of fantasy is added to this labyrinth of confusion by the fact that the material of *A. artipes* gathered by Lemmon, Rusby and Toumey in the Flagstaff region of northern Arizona are referred by Jones (*l. c.* 120) to *A. megacarpus* var. *Parryi* A. Gray, although he noted that they were abnormal in having ochroleucous flowers.

*Phaca jucunda* Jeps. and Rydb. has since publication been rightly reduced by Dr. Jepson himself (*Fl. Calif.* 2: 348. 1936) to *A. oophorus*. Apart from the criterion of color, which I believe to be chimerical, Rydberg advanced only the shape of leaflets to distinguish the segregate *P. jucunda* from *P. oophora*. A mere glance at any considerable suite of specimens, however, reveals that the shape of leaflets is in no way correlated with flower-color, with shape of pods or with distribution, for they may vary throughout the range of the species from crowded, suborbicular and retuse through many intermediate stages to remote, narrowly elliptic and acute (as in the Charleston material) and exactly similar variation occurs in *A. artipes*. Considerable variation occurs also in the length of the stipe and in the size of the corolla.

I am disposed, therefore, to regard the whole complex as a single species, of which *A. artipes* may be regarded as a well-marked variety, under the combination *A. oophorus* var. *caulescens* Jones. The pertinent literature is summarized in the following synonymy.

***Astragalus oophorus* S. Wats. var. *typicus* Barneby nom. nov.**

*A. oophorus* S. WATS., Bot. King 73. 1871. *A. oophorus* sensu M. E. JONES, Rev. Astrag. 120, *pro parte*, Pl. 21 (as to upper figures). *A. oophorus* var. *caulescens* M. E. JONES, *op. cit.* 121 lin. 32 (lapsu), non *ibid.* lin. 38. *A. oophorus* var. *artipes* M. E. JONES, *op. cit.*, Index to Plates and Pl. 23, *nomen nudum*, non *A. artipes* A. Gray. *Phaca oophora* (A. Gray) RYDB., N. Amer. Fl. 24:338. 1929. *P. jucunda* JEPS. and RYDB., in RYDB., *op. cit.* 339. *Astragalus jucundus* Jeps. and Rydb. ex PECK, Man. Pl. Oreg. 446. 1940, *nomen nudum*.

***Astragalus oophorus* S. Wats. var. *caulescens* (M. E. Jones) M. E. Jones**

*A. oophorus* S. Wats. var. *caulescens* (M. E. Jones) M. E. Jones, Rev. Astrag. 121, lin. 38, Pl. 22, 1923, non *ibid.*, lin. 31. *A. megacarpus* var. *caulescens* M. E. Jones, Proc. Calif. Acad. Sci. II, 5:643. 1895. *A. artipes* A. GRAY, Proc. Amer. Acad. 13:370. 1878. *A. oophorus* sensu M. E. JONES, Rev. Astrag. 120, *pro max. parte*, Pl. 21, fig. a, *nou* S. Wats. *Phaca artipes* (A. Gray) RYDB., Bull. Torr. Cl. 32:664. 1906; N. Amer. Fl. *l. c.*



**Astragalus straturensis** M. E. Jones

*Atelophragma straturensis* (M. E. Jones) Rydb. *Hamosa atratiformis* Rydb.

NEVADA: dry slopes among junipers and pinyons, 12 miles east of Panaca, Lincoln Co., alt. 7050 ft., 9 May, flor. *Ripley and Barneby 4386*. Also *ibid.*, 11 June, fruct. No. 4971.

A new record for Nevada. The flowers are bright violet-blue when fresh, with a pale, striate diamond in the fold of the banner.

This will almost certainly prove to be the same plant as that collected by Vernon Bailey (*Death Valley Exped. No. 1975*) "about 30 km. east of Panaca" in Utah and determined by Sheldon (ap. Cov., *Contrib. U. S. Nat. Herb.* 4: 87. 1893) as *A. obscurus* S. Wats. The latter species is not known south of the valley of the Humboldt River and has ochroleucous, not "purplish," flowers.

**Astragalus eremiticus** Sheld. var. **typicus** Barneby nom. nov.

*A. eremiticus* Sheld., *Minn. Bot. Stud.* 1:161. 1896, *sensu stricto*.

UTAH: Gunlock, Washington Co., with ochroleucous flowers. *Ripley and Barneby 4298*.

ARIZONA: Mokiak Pass, Mohave Co., with purple flowers. No. 4313. NEVADA: Pahranaagat Mts., west of Crystal Springs, Lincoln Co., flowers purple. No. 4408.

**Astragalus eremiticus** Sheld. var. **spencianus** M. E. Jones,

*Contrib. W. Bot.* 10:60. 1902

*A. boiseanus* A. NELS., *Bot. Gaz.* 53:223. 1912. *A. arrectus* var. *Kelseyi* M. E. JONES, *Rev.*

*Astrag.* 161. 1923, non *A. Kelseyi* Rydb. *Tium eremiticum* (Sheld.) RYDB., *N. Amer. Fl.* 24:390. 1929; *Bull. Torr. Cl.* 57:400. 1930, *pro parte*.

NEVADA: 10 miles west of Elko, Elko Co., in sagebrush. *Ripley and Barneby 4588*.

The type of this variety, though not specified by Jones, is evidently his collection from Spencemont (? Lander County), Nevada, in 1891 (PO), and is exactly similar to authentic material of *A. boiseanus* from the neighborhood of Boise, Idaho. Later Jones referred it as a variety to *A. arrectus* A. Gray, but mistakenly identified it with *A. Kelseyi* Rydb. which is *A. atropubescens* Coult. and Fish. and not certainly distinct from *A. arrectus*. Rydberg, in his review of *Tium* (*l. c.*, 1930), recognized the differences which exist between typical *A. eremiticus* and the var. *spencianus*, but was unwilling to separate them. Nonetheless the morphological criteria enumerated by him, when considered in the light of factors of distribution and habitat, appear amply sufficient to support a variety. The var. *typicus* is endemic to the arid, subdesertic ranges about the common boundary-point of Nevada, Arizona and Utah, always in the drainage of the Colorado River or its immediate tributaries such as the Muddy River or the Virgin, where it occurs on dry, stony slopes in the juniper-pinyon association, sometimes in depauperate sagebrush. The var. *spencianus*, on the other hand, occupies the interior basin region of north-eastern Nevada and adjacent Idaho and Oregon, in the drainage of the Owyhee, Snake and Humboldt rivers, where it is a characteristic element of the flora of sagebrush plains and valleys. It is not known to extend south of White Pine County, Nevada, and no intergrades have been seen.



**Astragalus Bryantii** Barneby spec. nov.

(Plate 17, figs. 10-18)

*Astragalus Bryantii* Barneby spec. nov. inter *Palantia* generis *Tii* Medic. sensu Rydb. adnumeranda, habitu pube etc. *A. mokiaccensi* A. Gray forsitan proxime affinis, sed ab eo consociisque omnibus leguminis angustioris valde compressi sutura ventrali acuta necnon pericarpio tenui diversissima et his notis *Hamosae Tricarينات* Rydb., a quibus imprimis tubo calyceino tubuloso nec campanulato longius distat, simulans.

Herba verosimiliter perennis, 'tripedalis' teste cl. Bryant, pube e pilis brevibus adscendentibus candidis constituta praeter foliolorum paginam superiorem glabratam undique strigosa, partibus junioribus villosulo-canescens: caulibus ut videtur adscendentibus (sed inis ignotis) plus minusve flexuosis striatis purpurascens: stipulis deltoideo-acuminatis extus strigosis herbaceis vel anguste scarioso-marginatis ca. 5 mm. longis, mox reflexis: foliis patulis subsessilibus vel breviter petiolatis, 8-12 cm. longis, rachi subtereti strigoso petiolum multoties superanti: foliolis 14-20, petiolo 0.5-0.75 mm. longo gestis, ovatis, late ellipticis vel obovatis, 5-14 mm. longis, 3-8 mm. latis, inferne strigoso-canescens: pedunculis firmis arcuato-adscendentibus striatis 4-5 cm. longis, in racemum laxum ca. 15-florum fructiferum vix elongatum nec folio suffuleranti multo longiorem abeuntibus: bracteis lanceolato-attenuatis ca. 2 mm. longis: floribus violaceis 15-17 mm. longis pedicello arcuato 1.0-2.5 mm. longo saepissime atropiloso suffultis: calycis membranacei pilis albis nigrisque commixtis strigosi tubo late cylindrico, 5 mm. longo, postice gibbo, ovario intumescens mox rupto, dentibus anguste subulatis acutis 1.5-1.75 mm. longis coronato: vexillo obovato 16 mm. longo, ca. 8 mm. lato, ad medium retrorsum arcuato sed apice profunde emarginato declinato, marginibus reflexis: alis ca. 14 mm. longis, lamina lunata obtusa 1.5-1.75 mm. lata, auriculo basali conspicuo incluso 7 mm. longa: carinae petalis ca. 13 mm. longis laminis latius lunatis saltem 7 mm. longis, 2.5 mm. latis, marginibus superioribus profundiuscule concavis, inferioribus (connatis) inferne rectis ad medium abrupte in apicem latum obtusissimum sursum arcuatis: legumine horizontaliter patulo vel leviter adscendenti, arete sessili, 2-loeulari, subrecto vel saepius paulum arcuato, ambitu lineari vel lineari-lanceolato, 2.0-2.5 (3) cm. longo, ad basin rotundato supra medium sensim attenuato, valde compresso, sulco 0.75-1.5 mm. alto impresso dorsaliter percurso, sutura ventrali per longitudinem totam prominula, dorsali ad ventralem usque introflexa septum subcompletum 2.0-2.5 mm. altum fere in leguminis apicem productum efformanti, valvulis chartaceis tenuiter reticulatis parvis strigulosis vel demum glabratissimis nonnunquam minute purpureo-guttulatis, sectione transversali anguste deltoideo-obcordata, 3.0-4.5 mm. alta, 1.5-3.0 mm. lata: seminibus oblique reniformibus, 2 mm. latis, brunneis.

ARIZONA: at the head of **Phantom Canyon** in the **Grand Canyon of the Colorado River, Coconino Co.**, 15 Dec. 1939. Collected by Dr. H. C. Bryant of the National Park Service in whose honor it is named.

*Type* in Herb. Calif. Acad. Sci. No. 293940. Also collected in sand at the mouth of Hermit Creek in the Grand Canyon, 10 April 1917. *Eastwood 5991* (G, F).

The type of *A. Bryantii* is apparently part of the collection referred to by Kearney and Peebles (Fl. Pl. Ariz. 486. 1942) as representing an undescribed species allied to *A. palans* M. E. Jones, but, although a real affinity may exist between the two, it has been found convenient for purposes of diagnosis to compare it rather with *A. mokiaccensis* A. Gray, with which it agrees more closely in the quality of the pubescence, in the violet, not reddish purple coloration of the corolla, and in the less marked curvature of the legume. From *A. mokiaccensis*, known only from a few localities on either side of the Colo-

rado River immediately below the Grand Canyon, *A. Bryantii* differs in the strongly compressed, more slender and sparingly strigose pods which are of thinner texture and spread horizontally from the axis of the raceme. Indeed the texture and compression of the pod, with its acute ventral suture, led me at first to regard the species as more intimately connected with forms of *A. arrectus* A. Gray (*Tium* ser. *Arrecta* Rydb.) or with *Hamosa* ser. *Tricarinatae* Rydb., but the complete absence of stipe and the cylindrical calyx-tube make such an alignment improbable, and the species is more naturally associated with *A. mokiaceensis*.

As far as can be seen from the limited material at hand, *A. Bryantii* is very constant in vegetative characters, but the shape of the pod is evidently variable. Normally, as always in *Eastwood 5991*, the pod is narrowly lance-attenuate in outline, the cross-section at the middle being about 3 mm. high. Attached to Dr. Bryant's specimen, however, there are several loose pods, essentially similar in structure and pubescence but half as broad again, the cross-section being 4.5 mm. high and the outline lanceolate, more abruptly acute rather than attenuate at apex. Although the plant from which these pods have fallen has not been studied, their measurements are included in the description of the species and they have been treated as an integral part of the type. A similar latitude of variation has been found by the writer to occur in a number of species in the genus.

***Astragalus Pattersonii* A. Gray, sens. strict.**

*Jonesiella Pattersonii* RYDB.

ARIZONA: red clay hills 2 miles east of Fredonia, Coconino Co., alt. 4900 ft. *Ripley and Barneby 4361*.

The specimens are almost exactly typical, with narrowly elliptic, subsessile, strictly erect pods. This form of the extremely polymorphic species was known to Rydberg only from Colorado, and has not been reliably reported outside of that state, though a closely allied form with spreading pods is common in the Navajo Basin. The *A. Pattersonii* of Tidestrom and Kittell (Fl. Ariz. and N. Mex. 214. 1941), if one may judge from the synonymy, is an aggregate containing a number of diverse forms.

***Astragalus ensiformis* M. E. Jones var. *typicus* Barneby nom. nov.**

*A. ensiformis* M. E. Jones, Rev. Astrag. 226. 1923. *A. ursinus* M. E. Jones, Proc. Calif. Acad. Sci. II, 5:658. 1895, non A. Gray. *Hamosa ensiformis* Rydb.

ARIZONA: gentle stony slopes among junipers in Mokiak Pass, north of Wolf Hole, Mohave Co., alt. 5300-5500 ft., 4 May, fl. and fr. *Ripley and Barneby 4311*.

The type-locality of *A. ensiformis*, "4 miles above Pagumpa," is very close to our station and the species has been collected elsewhere only by Peebles and Fulton in northern Navajo County (cf. Kearney and Peebles, Fl. Pl. Ariz. 488. 1942). The name is universally cited as having been published in 1895, but this is incorrect. Jones, it is true, described the species quite minutely

in that year (*l. c.*), but under the name *A. ursinus* A. Gray, merely suggesting *A. ensiformis* as an alternative should the plant prove as distinct as he suspected, and the combination was not validly applied until the Revision of *Astragalus* in 1923. Rydberg, who did not see the flowers, associated *A. ensiformis* with *A. Congdonii* S. Wats. and *A. drepanolobus* A. Gray, whereas, with its tubular calyx and enlarged, scarious stipules, it clearly belongs to his series *Malacae* of *Hamosa* and is closely related to *A. Minthorniae* (Rydb.) Jeps. In fact a collection from southern Utah, described below as a new variety, forms a passage between the two.

***Astragalus ensiformis* M. E. Jones var. *gracilior* Barneby var. nov.**

(Plate 17, fig. 28)

*Astragalus ensiformis* M. E. Jones var. *gracilior* Barneby var. nov. a var. *typico* nob. caule internodiis extensis duplo elatiori, floribus post anthesin haud deflexis, racemo fructifero minime secundo et praesertim legumine graciliori minus compresso patule erecto evidencius hirsutulo nec appresse striguloso diversa. Ab affini *A. Minthorniae* (Rydb.) Jeps., cujus habitum in memoriam nonnihil redigit, imprimis legumine magis arcuato haud dense sericeo-villoso facile separanda.

UTAH: in stiff soil among sagebrush, 5 miles south of Veyo, Washington Co., alt. 4900 ft. Ripley and Barneby 4951. *Type* in Herb. Calif. Acad. Sci. No. 300413.

So different was the superficial appearance of this variety from that of *A. ensiformis* var. *typicus* that it was thought in the field to represent an undescribed species, but subsequent study has shown that the differences, though striking, are not fundamental, and it cannot be specifically separated. In the typical form the decumbent stem, with congested internodes, does not exceed 15 cm. in length, the fruiting raceme is strongly secund, the flexuous pedicels are arcuate-reflexed and the sparingly strigose pods, though arched upwards, are essentially pendulous. The stems of the var. *gracilior*, on the other hand, are upright and slender, reaching a height of 3 dm., the raceme is not at all secund, while the more finely and densely pubescent pods are held erect or somewhat spreading on straight and rigid pedicels. There is no appreciable difference in the form of the flowers, though in the var. *typicus* they are reflexed after fertilization.

***Astragalus chamaemeniscus* Barneby**

NEVADA: in sand under sagebrush near the Geyser Ranch, N. Lincoln Co., alt. 6050 ft., 11 May, flor. Ripley and Barneby 4416.

This species was known previously only from extreme northeast Nye and adjacent White Pine counties in the valley of the White River.

***Astragalus Arthu-Schottii* A. Gray, *sensu restricto***

*A. Arthu-Schottii* A. GRAY, Proc. Amer. Acad. 6:209. 1863, pro max. parte, non op. cit. 7:337. 1867. *A. Coulteri* sensu S. WATS., Bot. King, 66, 435. 1871; A. GRAY, Bot. Calif. 1:146. 1880; SHELD., Minn. Bot. Stud. 1:140. 1894 et auct. mult. pro parte, quoad syn., non Bth. *A. lentiginosus* var. *borreganus* M. E. JONES, Contrib. W. Bot. 8:3. 1898; Rev. Astrag. 126, tab. 25. 1923. *A. lentiginosus* var. *Coulteri* sensu JONES, Rev. Astrag.

127. quoad syn.; JEPS., Fl. Calif. 2:357. 1936, quoad syn. et pl. cit. Schott. *A. agninus* JEPS., Man. Calif. 577. 1925; Fl. Calif. 2:355. 1936; HARRISON and KEARNEY, Journ. Wash. Acad. Sci. 22:227. 1932; MUNZ, Man. S. Calif. Bot. 270. 1935; KEARNEY and PEEBLES, Fl. Pl. Ariz. 487. 1942. *Cystium Arthu-Schottii* (A. Gray) Rydb., N. Amer. Fl. 24:407. 1923. *C. agninum* (Jeps.) RYDB., loc. cit. 408.

Study of the somewhat elaborate synonymy and literature cited will show that *A. Arthu-Schottii* is believed to be the oldest valid name for the plant which has been described and treated in comparatively recent years as *A. lentiginosus* var. *borreganus* Jones and *A. agninus* Jeps., and, while reasons might be advanced for discarding Dr. Gray's name as a permanent source of error and confusion, a reëxamination of the facts tends to support its revival into current use. *A. Arthu-Schottii* was first encountered by Schott during the exploration of the Mexican boundary in 1855, but his collections were not cited by Gray in the Botany of the Survey, doubtless because the specimens available to him were without fruit. Several years later, having received from Fremont additional material of what he took to be the same, Gray decided to publish the species, including in his concept a plant collected in northern Sonora by Capt. Smith. Thus the original *A. Arthu-Schottii* was founded on three elements, cited by Gray (*l. c.*) in the following words: "on the Mohave River, Fremont, 23 April. Diluvial banks of the Colorado near its mouth, 12 March, Schott. Boca Grande, Capt. E. K. Smith.", and each of which belonged to a different species. The Fremont specimen (NY) is a very depauperate, first-year individual of that form of *A. Coulteri* Bth. with small corollas which is common on the Mohave Desert of California and which is variously treated in modern literature as *A. lentiginosus* var. *Coulteri* or var. *Fremontii*: the Schott element, as will be established below, belongs to *A. agninus* Jeps.: while the material from Boca Grande, a fragmentary specimen with leaflets glabrous on the upper surface, though not susceptible of certain determination, is probably a form of *A. lentiginosus* var. *yuccanus* Jones (certainly not *Cystium eremicum* as annotated by Rydb.). In settling on the type of *A. Arthu-Schottii* the latter may be quickly discarded: not only was it cited last by Gray, but the only reference to it in the description seems to be "*foliolis . . . pagina superiore interdum glabrata*," and it must have formed a quite unimportant part of the species that the author had in mind. The choice between the Fremont and Schott elements, however, is more difficult, for the description fits both with almost equal exactness. Nevertheless the phrases dealing with the calyx—"calycis dentibus subulatis tubo oblongo-campanulato vix dimidio longioribus"—and with the keel—"carina majuscula subrecta vexillo paullo brevior"—are matched more closely by the corresponding organs of Schott's plants than by those of Fremont's and the description seems to have been prepared primarily from the former, the first collected and more copious specimens. For this reason, as well as to avoid the anomaly of excluding from the species named in honor of Schott the very elements which he himself collected, it seems proper to regard the Boundary Survey No. 256 in herb. Gray as the type.



As stated above, the material of *A. Arthu-Schottii* available to Gray was without fruit, and this is true both of the sheet now in herb. Gray as well as of the two in the Torrey herbarium (NY). In the Field Museum, however, there are three additional isotypic sheets, apparently from Schott's private herbarium, one of which has nearly mature legumes and belongs, quite uncontestedly, to *A. agninus* Jeps. Even without this further evidence the identity of Schott's plant would be almost certain from locality alone. The six sheets seen by the writer are variously annotated "Colorado Desert near Fort Yuma," "Colorado Desert, Sonora" and "Between San Diego and the Colorado," and whether or not these represent one or more separate gatherings it is clear that all came either from extreme southern Imperial County, California, or from closely adjacent Sonora, a territory from which *A. Coulteri* is totally unknown yet where *A. agninus* has been frequently collected. Nevertheless, starting with Watson in 1871, the Schott collection has been regularly determined by all students of the genus as *A. Coulteri* and is so annotated by Sheldon (NY) and cited by Jones and Jepson. The error is perhaps traceable back to Gray's publication, as early as 1867, (*l. c.*), of a revised description of *A. Arthu-Schottii* taken from fruiting material communicated by Cooper from the Mohave Desert ("Camp Cadz and elsewhere," G.) which is conspecific with the early Fremont collection but not with that of Schott, i. e. *A. Coulteri* var. It should be borne in mind that, at the time when Gray proposed *A. Arthu-Schottii*, *A. Coulteri* was known to him only from Bentham's description, and it is not surprising therefore that, when *A. Coulteri* was finally identified with the Cooper plant in fruit, the whole of *A. Arthu-Schottii* was also thought to belong there.

In the North American Flora (*l. c.*) Rydberg abandoned the accepted interpretation of *A. Arthu-Schottii*, recognizing it as a species in the genus *Cystium*, but the effect is somewhat marred by the fact that he recognized *Cystium agninum* and *C. Coulteri* as well. If one may judge from specimens in the New York Botanical Garden so annotated by Rydberg himself, his *C. Arthu-Schottii* contained, in addition to the original Schott collection (which he also regarded as typical), a number of plants from the Mohave Desert such as *Parish 4957*, *Elmer 3641*, etc., which are inseparable from the early Fremont collection, although that actual specimen he referred to *C. Coulteri* (Bth.) Rydb. ! It should also be remarked that in the same work (*l. c.*, *in syn.*) Rydberg incorrectly cited *A. lentiginosus* var. *borregeanus* as having been published by Jones in the Revision of Astragalus, whereas it actually had appeared as early as 1898 (*cf. supra*) and in addition failed to note Jones' excellent figure.

*A. Arthu-Schottii* is a plant of rather restricted distribution in the southwestern deserts from interior San Diego County, California, at Borrego Wells, *Orcutt*, type of var. *borregeanus* (PO), *Jepson 8883*, type of *A. agninus* (NY, fragments), to Yuma, Arizona, *Beckett & Nobles 8695* (G, F), southward just into Sonora about San Luis, *Harrison & Kearney 8434* (F), and north along the Colorado River to eastern San Bernardino County, California, at



Silver Lake, *J. T. Howell 3586* (CAS) and Nipton on the borders of Nevada, *Ripley & Barneby 3360*. The species is very closely allied to *A. Coulteri*, which it replaces south of the Coachella Valley, but differs in the annual root, lax fruiting racemes and scarcely inflated pod.

***Astragalus lentiginosus* Dougl. var. *cæsariatus* Barneby var. nov.**

(Plate 17, figs. 29–30)

*Astragalus lentiginosus* Dougl. var. *cæsariatus* Barneby var. nov. inter *Cystia neogea* Rydbergiana sive *Astragali Diphysos* A. Gray adnumeranda, caulibus prostratis, floribus congestis et legumine coriaceo *A. tehachapiensi* (Rydb.) Tidestr. proxime affinis, sed ab eo floribus maximis ca. 19 mm. longis saturate violaceis, dentibus calycinis longioribus acutis, legumine abruptius acuminato necnon racemorum axi calycibus bracteisque pube e pilis nigris laxius appressis constituta crebre indutis, satis superque diversa. *A. lentiginosus* var. *nigricalycis* M. E. Jones, qui etiam in iisdem finibus passim occurrit, caulibus paucis elatis, racemo laxiori, floribus minoribus saepissime ochroleucis, pube crispa implexa et legumine omnino albo-villosulo nec partim atro-strigoso a nostra distantius recedit.

CALIFORNIA: grassy slopes of the **Temblor Range above McKittrick, Kern Co.**, alt. 2900 ft., 13 April, fl. and fr. *Ripley and Barneby 3243*. Type in Herb. Calif. Acad. Sci. No. 289572.

The proposed variety is here referred to *A. lentiginosus*—*sensu latissimo*—in order to fit into Dr. Jepson's treatment of this complex group in the Flora of California, but the disposition is probably not final. The writer has spent many months in study of *A. lentiginosus* and its allies and it is now believed that a taxonomic arrangement based on a specific concept intermediate between the extremes of Rydberg, who recognized 33 species in *Cystium*, and of Jones, who regarded all the known races as varieties of *A. lentiginosus*, is not impossible. In spite of the fact that the specific limits would be somewhat blurred, it would appear feasible to recognize at least three major species, *A. lentiginosus*, *A. Coulteri* Bth. and *A. diphysus* A. Gray (approximately corresponding with Rydberg's three series *Lentiginosa*, *Coulteriana* and *Diphysa* of *Cystium*), under which the remainder, with several as yet undescribed, might reasonably be classified as varieties. In this case the var. *cæsariatus* would be referred to *A. diphysus* and associated closely with *A. tehachapiensis* (Rydb.) Tidestr. (Proc. Biol. Soc. Wash. 50:21. 1937, as *tehachapiensis*) yet easily separable by the larger, brilliantly colored corolla, acute calyx-lobes, sinuous stems, and by the pubescence of loosely appressed black hairs which invest the whole axis of the raceme, the pedicels and calyces, and which recur, mixed with white villi of similar structure, on the valves of the more abruptly cuspidate pod. *A. lentiginosus* var. *nigricalycis* M. E. Jones, the common race of the San Joaquin Valley, differs from ours in its taller stems, more lax racemes of smaller ochroleucous flowers, and by the tangled, curly pubescence of the stem, herbage and legume, the valves of which are larger and of thinner texture.

*A. lentiginosus* var. *caesariatus* is not uncommon on the eastern slope of the Temblor Range, where it forms large clumps among the ephemeral spring grasses, many annuals characteristic of the flora of the Great Valley foothills, and such perennial herbs as *Senecio Breweri* Davy and *Delphinium hesperium* var. *recurvatum* Jeps. The stems, arising from a heavy root and multicapital caudex, are very numerous, reclinate below but with ascending tips, and the subcapitate or short and dense racemes of large purple flowers with their contrasting striate eye on the banner make the variety one of the showiest of California *Astragali*. The specific epithet is derived from the Latin 'caesaries' and refers to the abundance of dark hairs in the inflorescence.

***Astragalus striatiflorus*** M. E. Jones, Proc. Calif. Acad.

Sci. II, 5:643. 1895

(Plate 17, figs. 19-24)

UTAH: locally abundant in white sand and on rock-ledges beneath sandstone cliffs, 10 miles north of Johanson Ranch, east of Kanab, Kane Co., alt. 5600 ft., 6 May, flor. Ripley and Barneby 4358. Ibid., 5 June, fl. and fr. No. 4815. Also beneath the white cliffs 5 miles south of Zion Park Junction, Kane Co., alt. 6100 ft. No. 4365.

This exceedingly obscure species has been known up to the present only from an inadequate fragment, devoid of pods, which was gathered by Jones "in red sand, above Springdale" (the western entrance to Zion Park, Washington County, Utah) in September, 1894. The type collection, Jones 6080k (PO), consists of a single very mature plant from which even the flowers have now fallen. The characteristic habit, however, the pubescence and curiously connate stipules still visible in the dried material, when taken in conjunction with the description of the flower and its attenuate keel, leave little doubt that our recent collections are determined correctly. Jones was apologetic about describing a species of *Astragalus* without knowledge of the fruit, but, convinced by the floral and other peculiarities of his material that he had before him a species "certainly belonging to the *Inflati* and probably near to *A. serpens*" (*l. c.*), he was unable to resist giving it a name. That his proposition was valid is now obvious, but in referring *A. striatiflorus* to the *Inflati* (approximately the genus *Phaca* as defined by Rydberg) Jones was far from the mark: actually the pod, while inflated, is bilocular and the affinity of the plant is probably with *A. platytropis* A. Gray. In the text of the Revision of *Astragalus* the species is not mentioned, but in the Index (which is not paginated) it is reduced without comment to *A. Sileranus* M. E. Jones, a true member of the *Inflati* with discrete stipules, quite different flowers and elongated stems. Rydberg, to whom the species was entirely unknown, cited *A. striatiflorus* in his list of omitted synonyms in *Astragalus* (N. Amer. Fl. 24:455. 1929), and could do little else but follow Jones' earlier reduction. As the species remains virtually undescribed to this day, it has been thought advisable to prepare a revised description with emphasis on the floral and carpological characters.

**Astragalus striatiflorus** M. E. Jones, char. fruct.

A low caespitose perennial herb with a fleshy taproot and loosely branched subterranean caudex, the stems and herbage densely and softly villous-canescens with white spreading and somewhat curly hairs. Stems very short, decumbent, clothed below with loosely imbricated stipules, the upper 2 or 3 internodes about 1 cm. long. Stipules very broadly obovate, truncate and often mucronate, 2-3 mm. long, scarious and many-nerved (the nerves more or less anastomosing), adnate neither to the stem nor to the petiole but connate around both to form a cup, strigose-villous without. Leaves 2-3 cm. long, the slender rachis and petiole subequal. Leaflets 11-13, petiolulate, obovate to oblanceolate, obtuse, truncate and mucronulate or rarely a little emarginate, often conduplicate, contiguous, the terminal smallest. Racemes short, loosely 3-5-flowered, on peduncles about equalling the leaves. Bracts ovate, acute or acuminate, scarious, longer or shorter than the spreading pedicels. Calyx purplish, villous-hirsute with white or some black hairs, the tube campanulate or obscurely obovate, 3-4 mm. long, oblique at the orifice, the acute teeth 2-3 mm. long, heteromorphous, the ventral pair deltoid-acuminate, the lateral pair and the dorsal one linear-subulate. Corolla 9-12 mm. long, ochroleucous or suffused with lavender, the banner striate with purple lines and the keel deeply purple-tipped. Banner with suborbicular blade 8-9 mm. broad, narrowed into a very short claw, arcuate much below the middle nearly to a right-angle, the margins spreading but not reflexed. Wings 8-9 mm. long, the blades lunate obtuse, about 2 mm. broad, including the large basal auricle 6 mm. long. Keel-petals equaling the wings, the blades 6-7 mm. long, obliquely lanceolate and arcuate upwards, strongly gibbous above the claw and there attached to the wings, the upper margins concave at the middle, the lower margins straight below, toward the middle abruptly convex and arched upward to the slightly declined apex of the long-attenuate but obtuse beak, free for 1 mm. below the summit. Style filiform, at full anthesis exerted about 1 mm. from the keel, geniculate below the capitate stigma. Pod bladdery-inflated, bilocular, 12-15 mm. long, spreading, sessile but seated on a minute boss within the calyx and readily deciduous therefrom, in outline broadly ellipsoid, rounded and somewhat oblique at base, abruptly acute and apiculate at the apex which is crowned by the coiled persistent style, shallowly sulcate along either suture, the ventral suture nearly straight, filiform, the dorsal introflexed to form a thin double partition 3 mm. high produced across the entire width of the cavity, the valves membranaceous, densely villous with white curled spreading hairs, mottled with purple, the cross-section suborbicular 6-7 mm. broad and a little less high, emarginate at the sulcate sutures. Seeds about 8 in either locule, obliquely reniform, compressed, about 2 mm. long, olive-green.

*A. striatiflorus* is set off from all known species of *Astragalus* by a combination of characters which excludes it from a place in any natural group hitherto defined. An attempt to determine the species from Rydberg's monograph leads the enquirer directly to *Cystium platytrope* (A. Gray) Rydb., or, more deviously, to *A. anisus* M. E. Jones, but the similarity between these plants is, I believe, rather superficial and based entirely on the structure of the pod. In the present paper it is not proposed to discuss the taxonomic position of *A. anisus*, which differs (*inter alia*) from *A. platytropis* and *A. striatiflorus* in the elongate flower and cylindric calyx-tube and which is probably correctly placed by Jones and Rydberg as an aberrant relative of the *Mollissimi* (*A. mollissimus* Torr. et spp. affin.). But the differences between the two last and the relationship of each to *A. lentiginosus* sens. latiss., i. e. *Cystium* of Rydberg, will be examined in more detail.

It has already been implied that a similarity between the pods of two given

species of *Astragalus* is not necessarily a criterion of affinity, but this assertion must be amplified, for, thus baldly stated, it stands in direct contradiction to Rydberg's most important principle of classification. All of Rydberg's later work on the genus, which culminated in his monographic revision for the North American Flora, is based on the primary assumption that carpological characters, even when of the most minute and quantitative nature, are of supreme value in the definition of groups or, in his terminology, of genera. Diversity in structure of the flower, stipules or pubescence he discarded as of quite secondary importance. By logical application of this principle, Rydberg was led to assume an affinity between species, scattered perhaps from the Levant to the Andes, which happened to have a similar width of septum in the pod, yet simultaneously to refer to widely separated groups two species intimately connected by ties of morphology and geography in which the septum was found to be strongly or weakly developed. Of course this method was satisfactory in parts, for many allied species do, as one would expect, bear similar pods, but in some cases it produced polyphyletic groups of great artificiality. Had Rydberg himself admitted this, it could be easily forgiven. But interior evidence from his published writings leaves little doubt that he proposed his genera as genuine phylae, as evolved expressions of a single heredity marked by a carpological structure common to all included members. And implicit in that belief was the conclusion that any two members of one genus are more closely related to each other than either can be to a member of another genus. With this principle in mind let us take an example from Rydberg's own work.

*Tium Wilsonii* (Greene) Rydb. is a species of *Astragalus* endemic to the high plateaux of northern Arizona, described by Greene as related to *A. diphyssus* A. Gray (*Cystium diphyssum* Rydb.) and reduced by Jones in synonymy to a variety of *A. lentiginosus* Dougl. The pod is lanceolate, leathery, slightly but not conspicuously inflated, with the valves introverted dorsally to form a partition and thus partially bilocular. The septum does not quite reach the ventral suture, but the gap is not above one millimeter in width. With this we may compare *Cystium agninum* (Jeps.) Rydb., discussed elsewhere in this paper. Here we have a pod of similar outline, little inflated, but the septum traverses the whole width of the cavity (sometimes less: cf. Jeps. ex char.: "... extending half way or nearly to the ventral suture") and the gap between the sutures is as a rule closed. Rydberg rightly disregarded the lack of inflation in the fruit of *C. agninum*, otherwise anomalous in his genus *Cystium*, yet attached sufficient importance to the equally quantitative character of the septum to refer *A. Wilsonii* to *Tium*, and we are led to believe that despite their manifest similarity in all other respects to *A. coulteri* and *A. diphyssus*, both Rydbergian *Cystia*, these two species of the southwestern states are more closely related to, respectively, the old-world *A. Cicer* L., genotype of *Cystium* and *A. sulcatus* L., genotype of *Tium*, than they are to one another.

This relationship is not, of course, ipso facto, impossible. But once the rela-



tionship is admitted we must also accept that the evolution of the septum stopped abruptly at an incalculably distant date and has since been stationary, while the differentiation of species has continued along other lines. However, when the marvelously diverse carpology of *Astragalus* is considered as a whole, and when one recollects the manner in which the pods of species accepted by Rydberg himself as closely allied may differ in size and shape, in length of stipe, in the degree of compression and inflation, and even (cf. *Tium platycarpum* and *T. racemosum*) in the very width of septum, it becomes clear that all parts of the fruit have been equally subject to evolutionary progress and recession in comparatively recent times. Indeed there seems to be no reason why the similarity of structure between the pods of Old and New World species, remarked by Rydberg and other taxonomists before him, cannot be explained as well by parallel development as by a common heredity. In this case no single carpological character, nor even general agreement in structure of the fruit, can be accepted as a reliable basis of a natural classification throughout the genus unless supported by other criteria of proved value: and the names of generic segregates such as *Cystium* and *Tium*, founded on European or Asiatic species, have a very questionable place, whether applied to genera, subgenera or sections, in the taxonomy of American *Astragalus*.

From this statement of generalities we may well return to the particular subject of the present note, *A. striatiflorus* and its immediate allies. In the interests of clarity the major characters of the species are contrasted in the following table with *A. platytropis* and *A. lentiginosus*.

	<i>A. striatiflorus</i>	<i>A. platytropis</i>	<i>A. lentiginosus</i>
Stems	shortly caulescent	subcaulescent	strongly caulescent
Pubescence	villous	loosely strigose	strictly appressed
Stipules	connate around stem and petiole	connate abaxially about the petiole	free or obscurely adnate to petiole
Keel	lance-attenuate equalling wings	oblong-truncate equalling wings	lunate obtuse shorter than wings
Style	exserted	included	included
Pod, bilocular and inflated	with septum formed by intrusion of dorsal suture, the ventral filiform	with septum formed by a narrow inflexion of the dorsal suture and a deeply produced wing from the ventral which extends below the insertion of the funicles	with septum formed as in <i>A. striatiflorus</i> , the ventral suture sometimes (especially in allied species) very narrowly introflexed but never below insertion of funicles

It will be seen at once that *A. striatiflorus* differs from its supposed allies (or, more precisely, from other species with bilocular, inflated pods) in the attenuate keel, exserted style, stipules and pubescence, and additionally from *A. platytropis*, of which it has nearly the habit, in the structure of the septum. *A. platytropis* (plate 26, figs. 25-28), on the other hand, is unique in the concretion of the stipules, in the septum and broadly truncate keel. In the



opinion of the writer the sum of characters peculiar to each isolates these species so fundamentally from the rest of *Astragalus* as to entitle them to rank as representative of sections in the genus. The following names are therefore proposed.

*Astragalus* sect. *Orocystium* Barneby sect. nov. *Cystium* ser. *Platytropia* Rydb., N. Amer. Fl. 24:405. 1929.

Legumen vesicario-inflatum, sutura dorsali anguste introplecata ventralique intus producta dimidium loculi altitudinem superanti biloculare: carina oblongo-truncata: stipulae circa petiolum abaxialiter coneretae, altrinsecae liberae. Species unica: *A. platytropis* A. Gray.

*Astragalus* sect. *Cystiella* Barneby sect. nov.

Legumen vesicario-inflatum, sutura dorsali introflexa biloculare: stylus ad anthesin exsertus: carina attenuata: stipulae multinerviae utrinque coneretae cupuliformes. Species unica: *A. striatiflorus* M. E. Jones.

Following the conclusion reached above that the New World species referred to *Cystium* by Rydberg are probably not allied to the original elements of Steven, and as this group has no acceptable sectional name in the form of a substantive, I also propose:

*Astragalus* sect. *Diplocystium* Barneby nom. et. stat. nov. *Astragalus* ser. *Astragalus* sect. *Diphysi* A. Gray, Proc. Amer. Acad. 6:192. 1863. *Astragalus* ser. *Eu-astragalus* sect. *Lentiginosus* Sheld., Minn. Bot. Stud. 1:168. 1894, exclus. spp. plur. *Cystium* Rydb., Bull. Torr. Cl. 32:659. 1905; N. Amer. Fl. 24:405, sequ. 1929, exclus. *C. platytropide*; Amer. Journ. Bot. 17:232. 1930, non *Cystium* Stev., nec *Astragalus* subgen. *Cercidothrix* sect. *Cystium* Bge. *Astragalus* sect. *Inflati* M. E. Jones, Rev. Astrag. 123, sequ. 1923, quoad sp. ultimam p. max. p. *Astragalus* subgen. *Diphysus* Tidestr., Contrib. Nat. Herb. 25:315. 1925. Species typica: *A. lentiginosus* Dougl. ex Hook.

While some pains have been taken to point out what are believed to be fundamental differences between these three sections, the converse and, I suppose, more valuable task of tracing their origin and real place in the genus cannot be attempted here. In the absence of exact cytological data such speculation is apt to be valueless and in any case is not susceptible of proof. I am inclined to suspect, nevertheless, that *Diplocystium* is derived from a common source with the *Mollissimi*: *Orocystium* and *Cystiella* seem to be more closely connected with each other than with any known species, but, in associating *A. platytropis* with *A. cobrensis* A. Gray, Jones may have hit on a real line of affinity.

EXPLANATION OF PLATE

PLATE 17

Figs. 1-9. *Astragalus musimonum* Barneby, spec. nov. (1) Pod  $\times 2$ . (2) Cross-section of pod  $\times 3$ . (3) Flower  $\times 2$ . (4) Calyx  $\times 2$ . (5) Banner  $\times 2$ . (6) Wing-petal  $\times 2$ . (7) Keel  $\times 2$ . (8) Leaf  $\times 1$ . (9) Stipules  $\times 2$ .

Figs. 10-18. *Astragalus Bryantii* Barneby, spec. nov. (10) Pod  $\times 1$ . (11) longitudinal cross-section of same  $\times 1$ . (12) transverse section of same  $\times 3$ . (13) Pod of broader type  $\times 1$ . (14) transverse section of same  $\times 3$ . (15) Flower  $\times 2$ . (16) Wing-petal  $\times 2$ . (17) Keel  $\times 2$ . (18) Leaf  $\times 1$ .

Figs. 19-24. *Astragalus striatiflorus* M. E. Jones. (19) Pod  $\times 2$ . (20) Cross-section of pod  $\times 2$ . (21) Flower  $\times 2$ . (22) Keel  $\times 2$ . (23) Seed  $\times 4$ . (24) Stipules  $\times 3$ .

Figs. 25-28. *Astragalus platytropis* A. Gray. (25) Cross-section of pod  $\times 1$ . (26) Keel  $\times 2$ . (27) Stipules  $\times 3$ .

Fig. 28. *Astragalus ensiformis* var. *gracilior* Barneby, var. nov. (28) pod  $\times 1\frac{1}{2}$ .

Figs. 29-30. *Astragalus lentiginosus* var. *cæsariatus* Barneby, var. nov. (29) Pod  $\times 1\frac{1}{2}$ . (30) Flower  $\times 1\frac{1}{2}$ .

Fig. 31. *Astragalus Whitedii* fma. *speirocarpoides* Barneby fma. nov. (31) Pod  $\times 2$ .

